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In-situ Precipitation Dataset in High Latitudes of the Northern Hemisphere for Calibration of GPM Mission Products

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Abstract: At high latitudes, frozen precipitation and precipitation of low intensity represent the lion‘s share of precipitation events and a substantial contribution to annual precipitation totals. Unfortunately, the existing precipitation gauge records should be bias-corrected and in high latitudes these corrections might be as high as 100% of measured totals and, what is more discouraging, measured precipitation might be overestimated too due to blowing snow events and misinterpretation of numerous low amounts of rainfall/snowfall that are below the sensitivity and/or precision thresholds of existing precipitation gauges. Currently, the reliability of remote sensing precipitation measurements over land is backed by the in situ gauge network. When going northward, at high elevations, and during the cold season in mid-latitudes, this support becomes —less adequate‖ due to increasing uncertainties of this backup network reports. Therefore,f uture products of the GPM Mission may be compromised across all cold regions if they do not use for calibration the best possible in situ updatable data set over the northern extratropics with daily or better time resolution together with a comprehensive assessment of precipitation measurements accuracy, bias treatment, and representativeness. To deliver such data set for the NASA Precipitation Science Research Team is a major objective of this proposal.
Approach. Firstly, we shall pull available synoptic and precipitation data sets for the northern extratropics (the data of more than 8,000 stations) and re-process them to secure bias-correction and proper treatment of low intensity precipitation measurements. This is a laborious step because correction of each precipitation record requires a lot of supplementary synoptic information and site metadata. Thereafter, we shall:_ Organize an orderly update of existing synoptic and precipitation datasets for the period sufficient for the GPM calibration effort to be completed; first of all, this will be done for the United States, Canada, Russia, and Belarus where the Research team members have a direct access to national archives, data collection streams, and quality control efforts._ Conduct the random error level assessment of point precipitation measurements for different weather conditions, precipitation gauge design, and observational practices after application of all bias corrections. This will be done using the entire historical period of record of our data holdings with particular foci on long-term field sites data comparisons in the vicinity of modern high precision sites such as the U.S. Climate Reference Network and its expansion to Russia and Canada._ Following the theoretical approach developed by Kagan (1997) and using the results of the previous step (that provide necessary parameters for this step), we shall conduct the representativeness studies for point precipitation measurements for different types of terrain and precipitation events at high and mid-latitudes. At this step, we shall not try to assess representativeness of the in situ precipitation network for large

territories and/or watersheds. Instead, we shall focus on the grid cell (pixel) level of future GPM products to further quantify the ability of the in situ gauge network to be used for surface based precipitation comparison products in the high latitudes, at high elevations, and in the cold season in mid-latitudes.